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TEREDO NOTES

BY

E. T. P. SHEWEN, RESIDENT ENGINEER OF THE PUBLIC WORKS DEPARTMENT

AT ST. JOHN, N. B.

(Read before the Natural History Society of New Brunswick.)

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Two inveterate enemies of timber are found in the waters of the maritime provinces, viz., the limnoria and the teredo, familiarly known as the nipper (or gribble) and the borer. Both are eminently destructive, but the depredation committed by the latter, being concealed until far advanced, is more dangerous than the manifest devastation of the former. For those who have never investigated the subject, it is difficult to realize either the extent of the damage inflicted, or the rapidity with which havoc is wrought among marine works by the unbuilding teredo.

The accompanying specimens of worm-eaten wood are from the coasts of Northumberland Strait, where they have remained in the tide-way from two to three years, a life comparatively long in those waters. In their present dry state, the actual flaccid condition of timber structures bored by this worm can scarcely by appreciated, for when first cast ashore, pulpy and sodden, these sieve-like sections were susceptible after the manner of sponge, to compression by the hand. Remembering this, it may be understood how readily piers and breakwaters, weakened by the borer, are knocked to pieces by the waves. The specimens exhibited were not detached piles, but the face-timbers, 12 inches square, of a work, securely bolted together tier upon tier, forming a solid wall with only one side exposed.

Unfortunately, the teredo carries on the work of demolition at even greater speed than was applied in this instance. Hemlock timbers, also a foot square, which had remained in the water at the same place, some for 12, some for 17 months, were found to be so throughly destroyed as to be easily penetrated through the side to a depth of 9 inches by simple pressure of the point of a walking-stick. Except at the ends, these timbers viewed casually, presented no unusual appearance; but when stepped upon, revealed by collapse of the deceptive surface, the utter ruin beneath. Closely examined, the outside seemed pierced by pin-holes gradually expanding towards the heart of the wood into tunnels the size of a pencil. At the same place, spruce piles 10 or 12 inches in diameter, driven early in July, came ashore cut off by the teredo, on the 3rd November following. In another example, timbers of the size already mentioned, had been reduced in width to six, and even five inches. In this case, the up and down bolts, driven at mid-breadth to fasten the tiers together, were bared, the surrounding wood having been entirely eaten away.

Either in the form of spawn, or soon after emerging from that stage, the teredo possesses the power of attachment to timber, and in less than two weeks is capable of pricking a small hole for entry. Once within, the progress of growth is attested by the gradual enlargement of the tunnel, until a diameter of perhaps three-eighths of an inch is attained in hardwoods. As growth proceeds, the necessity of boring to avoid being pinched is obvious. It is believed that the teredo draws nourishment from minute organisms in the water, the timber representing, not food but habitation.

In New Brunswick, the teredo infests the whole coast bordering on Northumberland Strait. In length it varies from one and a half to four inches, increasing as the facilities for boring, or breeding are multiplied. In one place, before a contemplated

work was begun, none were found to exceed the smaller size mentioned. After the work had been finished, the worms appeared in infinitely greater numbers, and attained double the former length. Apart from the extended accommodation thus provided by the large quantity of timber brought within reach of the teredo, doubtless the eddies, slackwater, and lee, formed by the projection of the work from the land across the current, were also favourable to development, the temperature rising in the still water.

The light-coloured, shell-like head of the teredo is somewhat globular in form, open in front, and lipped after the fashion of an auger. With this apparatus, it is supposed the work of destruction is done. The soft white body apparently receives protection from a fragile tube frequently found lining the tunnels. The vertical working range lies between the bottom and half tide, but specimens may be met in wood above that level. Destructive power is greatest when the temperature of the water is high, that is from the middle of July to the end of August, or a little later. By October the worm is less inclined to attack new timber, but whether autumnal inactivity becomes absolute dormancy in the winter is not positively known. It is believed that the teredo has one enemy, (*Lycoris fucata*) which also preys upon the pholas.

Experiments made in Northumberland Strait with pieces of pine, spruce, hemlock, birch, beech, and maple treenailed together, and exposed at low water mark from October to December, showed no trace of the worm when taken up. Another raft, similar to the last, but lacking the birch, placed under the ice on the 7th of February, was found after 77 days' immersion to be untouched also. Since these timbers were in contact with ice, the experiments do not conclusively establish torpidity in the cold months, for it is possible that in deeper water the worm may work during the winter. It would be interesting to know whether, in timbers between half-tide and low water, the worms are killed by frost. On the 20th of April following, the first raft was replaced in the water, and suffered to remain undisturbed until the 29th of October, a period of 192 days.

Upon examination, it was discovered that the pine and spruce had been demolished, only a portion of the sticks being left. The hemlock, while preserving the original outward form, had become a mere honeycomb, and the hardwoods were much in the same condition as the hemlock. In fact all the timbers were destroyed. When the rafts were carefully taken apart, it was found that teredines did not, as popularly reputed, invariably hold inviolate each others tunnels, but bored capriciously in every direction; that is to say, with the grain, directly across, or obliquely across it. More than this, there were instances in which they had bored from one stick into another below placed transversely to the first, the tunnel continuing across the seam. In such cases the timbers were hard up, without any film of water between, being tightly drawn together by the treenails. Of course, if the second timber had not been quite close to the first, it would have been entered by other worms through the intervening water. In several examples, the tunnels ran without interruption from the timbers through the treenails.

Near the close of the paper in Bulletin No. 8 (Natural History Society) upon the Mollusca of Acadia, it is suggested that since foul or brackish water is avoided by the teredo, the fact might be turned to practical account. One difficulty in the way of utilizing either, lies in the differing density of fresh and salt water. An apt illustration occurred at one of the Cape Breton coal mines. Some of the pit-water, strongly impregnated with iron, sulphurous, and otherwise unsavory, was discharged immediately alongside the colliery shipping-pier. For some time it was thought that the water conferred complete protection, for the timbers of the pier, highly coloured by it, showed no trace of the teredo. Later, it was discovered, by failure of the cribwork deeper down, that the stratum of red water ceased a few feet beneath the surface, and that in the pure salt water below, the worm flourished.

The Dutch commission referred to in Bulletin No. 8, was appointed in 1857, and began two years afterwards a series of careful experiments lasting for a period of years. The valuable result of the labours of that commission, reported in the

Popular Science Monthly for August and September, 1878, by Dr. E. H. Von Baumhauer, one of the members, represents the most reliable information extant upon the subject. Briefly, it showed that no mechanical protective application was of real service, and that only impregnation with creosote afforded immunity from attack of teredo or limnoria. In the use of creosote, it was found that two points were essential to success: (1) the oil must be of proper quality, (2) the process of impregnation must be thoroughly performed.

Considering No. 2 first, it may be said that the most approved process is that of Mr. S. B. Boulton, in which advantage is taken of the difference between the boiling point of water (212 F.) and of creosote (say 400 F. as a minimum) to evaporate all the sap and moisture in the timber by wet heat, and so to make with certainty room for the oil without injury to the fibres. At 250 degrees F. the woody fibre of timber begins to be decomposed, and the pyroligneous acids are distilled. At less than 212 degrees, evaporation of the moisture will not take place, hence attention to the thermometer in the conduct of the process is imperative. The creosote is introduced into the cylinders containing the timber to be treated at a temperature between 212 and 230 degrees. The sap thus vaporized rises to the surface, is drawn off through the dome by the vacuum pump, led to a condenser, and finally to a receiver where it may be measured. The creosote of course flows into the empty pores, but to make assurance doubly sure, the pressure pumps are put on up to 130 pounds per square inch.

Creosote is produced by simple distillation of tar, the mother of most of the commercial by-products of coal. The lighter oils, from which dyes, drugs, etc., are extracted by subsequent treatment, come over first, the creosote last, while a residue of pitch is left behind. The best creosote, known as London Oil, sp. g. about 1·055, is derived from Newcastle coal, through tar obtained by coking at high temperature. Since the preservative action of the oil is two fold, viz., chemical in the antiseptic sense, and mechanical in excluding the entrance of fresh germs by closing the pores, the specific gravity and the constituents become of the utmost importance. It is essential that as few as possible of the latter, should be either volatile below 600 F. or soluble in water. Wood creosote is of no use for marine purposes.

The substances eliminated by destructive distillation of coal are almost innumerable. Although results vary somewhat with the different measures, one ton of coal, 2,240 pounds, worth from 90 cents to $1.75 at the pit-mouth, usually yields for first results, besides ammoniacal liquor and illuminating gas, 1,200 pounds of coke worth $3.60 to $4 per ton, and 12 gallons of coal tar. Broadly speaking, the twelve gallons of coal tar give upon distillation:

Light oils....................................	1 to 1·5	gallons
Creosote and anthracene........................	3 to 4	do
Pitch, the residue.............................	6 to 7	do

These quantities fluctuate according to the time allowed for the different runnings, and the quality of the tar.

Although the value of creosote as a preservative is well known, and it is likely to be in request provided the oil can be placed in the market at a price sufficiently low to encourage the use, coal tar is not at present distilled in Canada. The undertaking should be feasible, since the oil is only one of many results from a single operation. In fact the production can be combined with manufacture of the almost infinite extracts obtained from the light oils given off before the creosote is reached. Besides, for the residue, pitch, now altogether imported, there is ready market even after the local requirements for use in artificial asphalt, roofing and other purposes are satisfied. On account of the growth of the oriental market for the patent fuel made at Cardiff by compressing culm into bricks, the demand at that port for pitch, one of the ingredients, exceeds the supply, notwithstanding the price, 27 shillings per ton, recently offered.

In making creosote and the other by-products of coal, the residue when all is over, consists of pitch equal to one-half, and sometimes two-thirds of the original quantity of tar placed in the still. An enterprise in which a residual product can

be shipped at good profit appears to offer advantages worthy of consideration. Yet near New Glasgow, where 125 tons of coke are sometimes made daily, by burning 250 tons of coal, the ovens are not constructed to save the tar, about three thousand gallons being, as it were, wasted every day when coke is made. The maritime provinces, abounding in coal said to resemble in composition the Newcastle seams, present a field so eminently suitable for manufacture of the by-products, that the establishment of an industry capable of indefinite expension can only be a question of time.

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